MASTER OF SCIENCE

**General Information for Students**

**PROFILE OF ZOOLOGY DEPARTMENT**

 Jai Narain Vyas University right from its inception in 1962 continued to transfuse its academic vision at the hands of eminent faculty, till today. We take pride and feel honoured that our University was inaugurated by the then President of India, Dr. Sarvappaly Radhakrishnan. Distinguished Professor B. N. Jha took the reins in his hands as the first Vice Chancellor and since then, all the subsequent Vice Chancellors with their vision and wisdom steered this University to its academic summits.

 Jodhpur, being the oasis of Rajasthan carries a long heritage of bravery , courage and known for its communal harmony on one side and progressing, forming an identity as an educational hub, on the other, with Medical College, Law University, Ayurveda University , Engineering College, CAZRI, AFRI, DMRC ,AIMS ,ZSI and BSI. As the state University, Jai Narain Vyas University has become the centre for graduate and postgraduate courses in all the faculties besides catering to the needs of students of Western Rajasthan, it offers job-oriented Courses like physical education, defence studies, BBA,BCA,MCA,B.Ed. M.Ed There is a facility of self -finance courses in 35 subjects also.

 Established in 1963, the Department of Zoology has been imparting knowledge to youth and trigging research in vital fields like Entomology, Fisheries and Cell Biology. During seventies Parasitology and Environmental Science were included to the curriculum of M. Sc. This Department is perhaps the first in the country that initiated intensive teaching and research on different facts of environment concerning the Great Indian Desert. Commenting on the environmental teaching and research acumen of our department, the Vth Five Year Plan Visiting Committee of UGC asserted that “this department is pioneer in the country to have included environmental sciences in the teaching and research” Likewise, the Department is a premier institution in the country on Insect Taxonomy, morphology, physiology, Sericulture studies besides lower Primate ecology and behaviour with dozens of Ph. Ds, hundreds of papers, books and monographs published in the last 50 years, besides developing a long range of bilateral collaborative programmes with Germany and the U. S. A.

 The Department is nurtured by a highly talented faculty comprising of 23 teachers. We teach about 2000 undergraduate and 70 postgraduate students per annum. Our faculty supervisors guide around 15-20 research scholars every year for their Ph. D. degrees. The researches conducted by the faculty are in the fields of diabetes, atherosclerosis, primate behavior, aquaculture, bee & bats taxonomy and biology, silviculture, water pollution, insect pests and their control, bioinformatics and reproductive physiology of mammals.

 This Department has organized several academic congregations from regional to international level. These events have been shared by several international and national dignitaries of Zoology. It has played quite active collaborative role in the events organized by other institutes of this area such as Desert Medicine Research Centre, Zoological Survey of India, Forest Research Institute, Central Arid Zone Research Institute and many non-governmental – social service organizations.

 The Faculty of this Department has represented in several national and international academic bodies and policy formulation committees at home and abroad. Many faculty members have been invited to participate in national and international assemblies during this period. A large number of publications have come out from the department in national and international journals. The department got two UGC Scheme i.e Centre with Potential for Excellence in Particular Ares (CEPA) and DRS-I.

**ACADEMIC STAFF WITH SPECIALIZATION**

 **Faculty Members Specialization**

1. Dr. L.S. Rajpurohit, Professor & Head Behavior
2. Dr. Ashok K. Purohit, Professor Physiology & Ecology
3. Dr. G. Tripathi, Professor Physiology & Eco-toxicology
4. Dr. Seema Trivedi, Professor Cell Biology
5. Dr. Vimla Sheoran, Professor Cell Biology
6. Dr. Anil Choudhary, Professor Fisheries
7. Dr. Naresh Vyas, Professor Parasitology
8. Dr. Kavita Naruka, Professor Physiology
9. Dr. Divya Choudhary, Assistant Professor Parasitology
10. Dr. Pankaj Nama, Assistant, Professor Limnology
11. Dr. Dhirender Choudhary, Assistant Professor Cell Biology
12. Dr. Gemra Ram Parihar, Assistant Professor. Environmental Biology
13. Dr. Heera Ram, Assistant Professor Fisheries & Physiology
14. Dr. Bhanwaroo Ram Jaipal, Assistant Professor Environmental Biology
15. Dr. Meenakshi Meena, Assistant Professor Entomology
16. Dr. Ram Prakash Saran, Assistant Professor Cell Biology
17. Dr. Lekhu Gehlot, Assistant Professor Entomology
18. Dr. Hem Singh Gehlot, Assistant Professor Environmental Biology
19. Dr. Poonam Poonia, Assistant Professor Environmental Biology
20. Dr. Shanker Lal Nama, Assistant Professor Parasitology

 **COURSES OFFERED**

Besides teaching Zoology to undergraduate students, the department is imparting knowledge to postgraduates in five major disciplines of Zoology namely, Cell Biology, Entomology, Parasitological, Fish, Fisheries & Limnology and Environmental Biology.

The Department carries research in various fields from biology, experimental physiology, primate ecology and behaviour, zoo- and phytoplankton studies, water pollution, insect pest management, , histo-chemistry , bat ecology ,bioinformatics and wildlife studies. All these fields figure out very well in the departments’ research agenda.

The examination for the degree of Master of Science in Zoology will consist of two examinations (i) The previous Examination, and (ii) The Final Examination.

The examination will be through theory papers/practicals. Pass marks for the pervious and final examination are 36% of the aggregate marks in all the theory papers and practical and not less than 25% marks in an individual theory paper. A candidate is required to pass in the written and the practical examinations separately.

Successful candidates will be placed in the following division on the basis of the total marks obtained in previous and final examinations taken together.

First division 60%, Second division 48% and Thrid division 36%, No student will be permitted to register himself /herself simultaneously for more than one post-graduate course.

Note: Special paper will be allotted on merit-cum-choice basis with equal number of students in each paper

**ATTENDANCE**

1. For all regular candidates in the faculties of Arts, Education and Social Science, Science, Law and Commerce the minimum attendance requirement should be that a candidate should have attend at least 75% of the lectures delivered and tutorials held taken together from the date of her/his admission.

2. The shortage of attendance upto the limits specified below may be condoned.

(i) Upto 3% of the total (a) Lectures delivered and tutorials held (taken together), and (b) Practicals of Practicals and Sessionals subject-wise condonable by the Dean/Director/Principal on the recommendation of the Department concerned.

(ii) Upto 6% including (i) above by the Syndicate on the recommendation of the Dean/Director/Principal.

(iii) Upto further 5% attendance in all subjects/papers/practicals and sessionals(taken together) by the Vice Chancellore inspecial cases, on the recommendation of the Dean/Director/Principal.

3. The N.C.C. cadets sent out to parades and camps and such students who are deputed by the University to take part in games, athletics or cultural activitics may, for purpose of attendance, be trated as present for the days of their absence in connection with aforesaid activities and that period shll be added to their total attendance subject to the maximum of 20 days.

4. Advantage of fraction while calculating the attendance, shall be given to the candidate.

**M.Sc. (Previous) Zoology Examination, 2019-20**

*Note*: Each theory paper is divided in three parts i.e. Section-A, Section –B and Section –C.

Section-A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry of 2 marks.

Section –B: Will consist of 10 questions. Each unit will be having two questions; students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question carry 7 Marks.

Section-C: Will consist of total 05 questions. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question carries 15 Marks.

### **Paper I**

### **Zool. 401 – Invertebrate Structure and Function**

Unit 1

Organization of coelom: Acoelomates, Pseudocoelomates, Coelomates: Protostomia and Deuterostomia

Locomotion: Movement in Ciliates, Flagellata, Coelentrata, Annelida and Echinodermata

Unit 2

Nutrition: Feeding and digestion in lower and higher invertebrates.

### Unit 3

Respiration: Organs of Respiration: Aquatic and aerial respiration; respiratory pigments; Mechanism of respiration; Excretion: Organs of excretion: Coelom, coelomoducts, nephridia and malphigian tubules, coxal gland, Kaber’s organ, Bojanus organ; Mechanisms of excretion and osmoregulation.

Unit 4

Nervous system: Coelenterata, Platyhelminthes, Nematoda, Annelida, Arthropoda (Crustacea and Insecta) and Mollusca (Cephalopoda) and Echinodermata; Trends in neural evolution.

Unit 5

Invertebrate larvae: Larval forms of free-living invertebrates; larval forms of parasites, Strategies and Evolutionary significance of larval forms. Minor phyla: Concept and significance, Organization and general characters of Nemertini, Nematomorpha and Rotifera.

### **Paper II**

### **Zool. 402 - Biosystematics and Quantitative Biology**

Unit 1

Science of Taxonomy: Definition, Concepts,History, Scope and Applications of biosystematics. Biological species category; Code of Zoological Nomenclature and Operative Principles. Applications of Important rules Formation of Scientific names. Neotaxonomy: Chemotaxonomy, Cytotaxonomy, Molecular taxonomy.

Unit 2

Taxonomic procedure – collection, preservation, curetting, identification. Taxonomic characters; Quantitative & qualitative analysis of variation; Taxonomic keys, their kinds, merits & demerits; Taxonomic decision on the species level; Procedure of Classifying; Taxonomic publications; Different kinds of Types and their significance.

Unit 3

Methods in field Biology and estimating population density of Animals, ranging patterns through direct, indirect and remote observations, habitat characterization- ground and remote sensing methods.

Unit 4

Introduction to Biostatistics; Collection of data and their presentation such as Graphs, Bar diagrams, Histograms, Line diagrams, Pie diagrams; Measures of Central tendency - mean, median and mode; Analysis of variance and standard deviation. Probability theory, distribution and their properties.

Unit 5

Hypothesis testing, Chi-square(X2) test, students‘t’ – test, experimental design and sampling theory; Evaluation of Species indices: Shannon-Weinner index, Dominance index, Similarity and dissimilarity index, Association index.

**Paper III**

## **Zool. 403 - Vertebrate Physiology**

Unit 1

Biochemical process of food digestion, absorption and assimilation. Different types of vitamins, their physiological functions and effects of their deficiency.

Respiration – kinds of respiratory pigments, mechanism of breathing and gaseous exchange. Cellular respiration.

Unit 2

Cardio vascular systems, comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG- its principle and significance Cardiac cycle, heart as a pump, blood pressure neural and chemical regulation of all above.

Unit 3

Structure and types of nephrons, counter-current mechanism of urine formation, urea cycle physiology of osmoregulation in marine and fresh water vertebrates, structure of eye, ultrastructure of rod and cone cells, molecular physiology of vision.

Unit 4

Types of muscle, their ultrastructure and physiology of contraction; Structure and function of various endocrine glands, abnormalities and endocrine regulation.

Mechanism of action of peptide and steroid hormones.

Unit 5

Nerve conduction, types of neurotransmitters and their mode of action; cholinergic mechanisms; Thermoregulation, hibernation, bioluminescence, chromatophores and colour change.

**Paper IV**

## **Zool. 404 – Ecology and animal behavior**

Unit 1 Ecological energetic: energy flow, primary production and estimation of primary productivity in terrestrial and aquatic ecosystem.

 Concept of community, its nature, structure, species diversity and its measurement.

 Ecological succession: types, mechanism and concept of climax.

Unit 2 Population ecology: Characteristic of population, population growth curves, population regulation, life history strategies (r and k selection), concept of meta population- demes and dispersal, interdemic extinctions, age structure and life tables.

 Interspecific and intra specific interaction.

Unit 3 Applied ecology: Global environmental changes, biodiversity status, monitoring and documentation, major drivers of biodiversity changes, biodiversity management approaches, principles of conservation.

Unit 4 Approaches and methods in study of behaviors, developments of behavior: Instinct, learned behavior, learning imprinting, kineses, taxes, reflexes and Lorenz’s psychohydraulic model of motivation behaviour, motivation and its phases.

Unit 5 Role of brain in animal behavior, hormones and reproductive behaviour in insects and mammals, social behaviour with special reference to insects, fish, birds and mammals, social organization and communication.

Practicals

Time : 8-12 hours Max. Marks : 200

Min. Pass Marks : 72

(Two days for each Board)

Min. Pass Marks for each Board 36 Marks

Board I : Covering Papers I and II of Theory Max Marks 100

Board II : Covering Paper III and IV of Theory Max Marks 100

**Practicals**

Board I

1. Dissections/ Demonstration of dissection of same invertebrates

2. Microscopic Preparations

3. Identifications / Comment up on Spots (8)

4. Assessment of Biodiversity in Habitat

5. Influence of Climatic Factors on Biodiversity index in Desert

6. Preparation of models showing the status of certain taxa/species in a particular habitat

7. Biostatistics problems:-

1. To drive mean, mode and median
2. Derivation of standard deviation
3. Problem on correlation and regression
4. Application of Chi-square (X2) test
5. Analysis of level of significance

8. Collection tour report.

**Marking Scheme**

Board I Marks: 100

 (Min. Pass Marks: 36)

1. Dissection/diagrammatic presentation of Dissection 18

2. Preparations (s) 06

3. Identification and comments on spots (eight) / Systematics 24

4. Biostatics problem (s) 10

5. Year work and internal assessment:

 Practical records 10

Submission of slides 04

6. Tour of presentation of its report 18

7. Viva-voce 10

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 Total Marks 100

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### For ex-student, the marks of year work, internal assessment and tour reports may be readjusted by the examiners by raising the marks in items 1 to 4 according to the set parameters.

Board II

1. Detection of carbohydrate, proteins and lipids in milk
2. To demonstrate salivary digestion
3. To determine the respiratory rate of rat
4. Total R.B.C. Count
5. Total W.B.C. Count
6. Differential leukocyte count (DLC)
7. Estimation of haemoglobin content in mammalian blood
8. Packed Cell Volume (PCV)
9. Blood sugar estimation
10. To detect and separate amino acids with paper chromatography
11. Separation and detection of carbohydrate with paper chromatography
12. Demonstration of reflex action
13. To determine the total amount of water in a rat
14. To determine the percentage of fat in a mammal
15. To study the temperature variation at various points in a body of mammal
16. Qualitative test for urea, creatinine, and chloride in urine
17. Water analysis of CO2, O2, HCO3, pH, hardness, study of water bodies to identify zoo planktons and making their permanent preparations
18. Soil composition and classification
19. Estimation of water holding capacity and moisture content of soil
20. Air: Measurement of climatic factors like temperature, rainfall, humidity, pressure and wind speeds, etc.
21. Garden snail habituation to vibration
22. Investigation of nest structure in pigeon
23. Simple measure of dominance in rats/mice
24. Practical Records
25. Microtomy of different tissues

**Marking Scheme**

Board II

 Max. Marks: 100 (Min. Pass Marks: 36)

1. Physiological Experiments (i) Major 15

 (ii) Minor 10

2. Ecological Experiments (i) Major 15

 (ii) Minor 10

3. Permanent Preparation 08

4. Microtomy 15

5. Year work and internal assessment:

 Practical record & slides 10

Microtomy slides 07

6. Viva-voce 10

**Total Marks 100**

For ex-student, the marks of year work and internal assessment may be readjusted by the examiners by raising the marks in items 1 to 4 according to the set parameters.

Suggested Reading Material (All latest editions)

1. M. Kato: The Biology of Biodiversity, Springer.

2. J.C. Avise. Molecular Markers, Natural History and Evolution, Chapman & Hall, New York.

3. E.O. Wilson. Biodiversity, Academic Press, Washington.

4. G.G. Simpson. Principle of animal taxonomy, Oxford IBH Publishing Company.

5. E. Mayer. Elements of Taxonomy, Tata McGraw Hill, N. Delhi.

6. E.O. Wilson. The Diversity of Life (The College Edition), W.W. Northem & Co.

7. B.K. Tikadar. Threatened Animals of India, ZSI Publication, Calcutta.

8. Batschelet, E. Introduction to mathematics for life scientists. Springer-Verlag, Berling.

9. Jorgensen, S.E. Fundamentals of ecological modeling. Elsevier, New York.

10. Swartzman, G.L., and S.PO. Kaluzny. Ecological simulation primer. Macmillan, New York.

11. Lendren, D. Modelling in behavioral ecology. Chapman & Hal, London, UK.

12. Sokal, R.R. and F.J. Rohlf. Biometry. Freeman, San Francisco.

13. Snedecor, G.W. and W.G. Cochran. Statistical methods. Affiliated East-West Press, New Delhi (Indian ed.).

14. Green, R.H. Sampling design and statistical methods for environmental biologists. John Wiley & Sons, New York.

15. Murray, J.D. Mathematical biology, Springer-Veriag. Berlin.

16. Pielou, E.C. The interpretation of ecological data : A primer on classification and ordination.

1. Hyman, L.H. The invertebrates. Vol. I. Protozoa through Ctenophora. McGraw Hill Co., New York
2. Barrington, E.J.W. Invertebrate structure and function. Thomas Nelson and Sons Ltd., London
3. Jagerstein. G. Evolution of Metazoan life cycle. Academic Press, New York & London.
4. Hyman, L.H. The Invertebrates. Vol. 2. McGraw Hill Co., New York
5. Hyman, L.H. The Invertebrates. Vol. 3. McGraw Hill Co., New York
6. Hyman, L.H. The Invertebrates. Vol. 4. McGraw Hill Co., New York
7. Hyman, L.H. The Invertebrates. Vol. 5. McGraw Hill Co., New York
8. Hyman, L.H. The Invertebrates. Vol. 6. McGraw Hill Co., New York
9. Hyman, L.H. The Invertebrates. Vol. 7. McGraw Hill Co., New York
10. Hyman, L.H. The Invertebrates. Vol. 8. McGraw Hill Co., New York
11. Hyman, L.H. The Invertebrates. Vol. 9: Aves. McGraw Hall Co., New York and London
12. Barnes, R.C. Invertebrate Zoology, III edition. W.B. Saunders Co., Philadelphia.
13. Russel-Hunter. W.D. A biology of higher invertebrates. The Macmillan Co. Ltd., London
14. Read, C.P. Animal Parasitism. Prentice Hall Inc., New Jersey
15. Sedgwick, A.A. Student Text Book of Zoology, Vol. I, II and III. Central Book Depot., Allahabad.
16. Parker, T.J., Haswell, W.A. Text book of Zoology Vol. I, Macmillan Co., London.

28. Molecular Cell Biology, J. Darnell, H. Lodish and D. Baltimore Scientific American Book, Inc., USA.

29. Molecular Biology of the Cell, B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts, and J.D. Watson. Garland Publishing Inc., New York.

30. Dobzhansky, Th. Genetics and Origin of Species, Columbia University Press.

31. Dobzhansky, Th. F.J. Ayala, G.L. Stebbines and J.M. Valentine. Evolution. Surjeet Publication, Delhi.

32. Futuyama, D.J. Evolutinary Biology, Suinuaer Associates, INC Publishers, Dunderland.

33. Hartl, D.L. A Primer of Population Genetics. Sinauer Associates, Inc, Massachusetts.

34. Jha, A.P. Genes and Evolution. John Publication, New Delhi.

35. King, M. Species Evolution – The role of chromosomal change. The Cambridge University Press, Cambridge.

36. Merrel, D.J. Evolution and Genetics. Holt, Rinchart and Winston, Inc.

37. Smith, J.M. Evolutinary Genetics. Oxford University Press, New York.

38. Strikberger, M.W. Evolution. Jones and Bartett Publishers, Boston London.

39. Austen, C.R. and Short, R.V. Reproduction in animals

40. Schatten and Schatten. Molecular biology of fertilization.

41. F.T. Longo. Fertilization, Chapman & Hall.

42. R.G. Edwards. Human Reproduction.

43. Animal Cell Culture – A practical approach, Ed. John R.W. Masters, IRL Press.

44. Introduction to Instrumental analysis, Robert Braun. McGraw Hill International Editions.

45. Biologists Guide to Principles and Techniques of Practical Biochemistry, K. Wilson & K.H. Goulding, ELBS Edn.

46. Eckert, R. Animal Physiology: Mechanisms and Adaptation. W.H. Freeman and Company, New York.

47. Hochachka, P.W. and Somero, G.N. Biochemical Adaptation. Princeton, New Jersey.

48. Hoar, W.S. General and Comparative Animal Physiology, Prentice Hall of India.

49. Schiemdt Nielsen. Animal Physiology: Adaptation and Environment. Cambridge

50. Strand, F.L. Physiology: A regulatory Systems Approach. Macmillan Publishing Co., New York.

51. Pummer, L. Practical Biochemistry, Tata McGraw-Hill.

52. Prosser, C.L. Environmental and Metabolic Animal Physiology. Wiley-Liss Inc., New York.

53. Wilson K. and Walker, J., Practical Biochemistry.

54. Willmer, P.G. Stone, and I. Johnson. Environmental Physiology. Blackwell Sci. Oxford, UK, 644pp.

55. Newell, R.C. (ed.) 1976. Adaptation to environment. Essays on the physiology of marine animals. Butterworths, London, UK, 539pp.

56. Townsend, C.R. and P. Calow. Physiological Ecology: An evolutionary approach to resource use. Blackwell Sci. Publ., Oxford, UK.

57. Alexander, R.M.N. Optima for animals. Princeton Univ. Press, Princeton, NJ.

58. Dejours, P., L. Bolis, C.R. Taylor and E.R. Weibel (eds.), Comparative Physiology: Life in Water and on Land. Liviana Press, Padova, Italy.

59. Johnston, I.A. & A.F. Benett (eds.). Animals and Temperature : Phenotypic and evolutionary adaptation. Cambridge Univ. Press, Cambridge, UK.

60. Louw, G.N. Physiological animal ecology. Longman Harloss, UK.

61. E.J.W. Barrington. General and Comparative Endocrinology, Oxford, Clarendon Press.

62. P.J. Bentley. Comparative Vertebrate Endocrinology. Cambridge University Press.

63. R.H. Williams. Text Book of Endocrinology, W.B. Saunders

64. C.R. Martin, Endocrine Physiology. Oxford Univ. Press.

65. A. Gorbman et al. Comparative Endocrinology, John Wiley & Sons.